

**Kentucky Pollutant Discharge Elimination System (KPDES)**

**High Quality Water Alternative Analysis**

The Antidegradation Implementation Procedures outlined in 401 KAR 5:030, Section 1(3)(b)5 allows an applicant who does not accept the effluent limitations required by subparagraphs 2 and 3 of 5:030, Section 1(2)(b) to demonstrate to the satisfaction of the Environmental and Public Protection Cabinet that no technologically or economically feasible alternatives exist and that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the water is located. The approval of a POTW's regional facility plan pursuant to 401 KAR 5:006 shall demonstrate compliance with the alternatives analysis and socioeconomic demonstration for a regional facility. This demonstration shall also include this completed form and copies of any engineering reports, economic feasibility studies, or other supporting documentation

**I. Permit Information**

<b>Facility Name:</b>	Cash Creek Generation, LLC	<b>KPDES NO.:</b>	Application Pending
<b>Address:</b>	KY State Highway 1078	<b>County:</b>	Henderson
<b>City, State, Zip Code:</b>	Henderson, KY 42420	<b>Receiving Water Name:</b>	Green River

**II. Alternatives Analysis - For each alternative below, discuss what options were considered and state why these options were not considered feasible.**

1. **Discharge to other treatment facilities.** Indicate which treatment works have been considered and provide the reasons why discharge to these works is not feasible.

Both on-site and alternative third-party treatment works have been considered by Cash Creek Generation, LLC (the "Applicant" or "CCG"). On-site treatment facilities, including an inlet water treatment facility, a Zero-Liquid-Discharge ("ZLD") facility, and a sanitary wastewater treatment facility, have been selected for implementation in preference to use of third-party treatment works. Attachment II-1. provides details on the on-site and alternative treatment facilities that were evaluated.

2. **Use of other discharge locations.** Indicate what other discharge locations have been evaluated and the reasons why these locations are not feasible.

In addition to the third-party treatment works addressed in Section II-1., the Applicant considered discharge to other surface waters located in proximity to the Cash Creek Generating Station. Cash Creek is a small, weather-dependent tributary to the Green River that flows through the CCG property. When influenced by wet weather, the mean annual flow of Cash Creek is 10 million gallons per day (MGD) or 6,944 gallons per minute (gpm), with the lowest mean flow during seven consecutive days over a ten year period being 0, and the lowest mean flow during seven consecutive days over a two year period also being 0. Thus, alternative surface water discharge points into Cash Creek were all rejected due to the fact that Cash Creek has significantly lower flow rates than the Green River and the discharges would immediately drain to the Green River. Based upon flow volumes, discharge from the facility into Cash Creek would disrupt the natural flow characteristics and aquatic habitat of the stream.

## II. Alternatives Analysis - continued

3. **Water reuse or recycle.** Provide information about opportunities for water reuse or recycle at this facility. If water reuse or recycle is not a feasible alternative at this facility, please indicate the reasons why.

The Applicant has designed the Cash Creek Generating Station ("CCGS") to maximize reuse and recycle of water. Specifically, the following three (3) reuse/recycle processes are encompassed within Applicant's KPDES application (Items 1-4). Additional alternatives were also reviewed, but not included in the KPDES application (Item 5).

- 1) All rainfall that contacts the CCGS coal pile is captured in a coal pile run-off pond and is then recycled to the gasifier slurry process to eliminate the need for a coal pile run-off outfall to the Green River.
- 2) All gasifier process wastewater is treated in a ZLD with the resultant clarified water (598 gpm) recycled to the gasification process.
- 3) Cooling tower make-up water is recycled to seven (7) cycles of concentration to reduce the cooling tower blowdown from 430,000 gpm to 1,224 gpm (a 99.72% reduction). In addition, high efficiency drift eliminators on the cooling tower as required by the CCGS air permit allows for a closed loop water recirculation system for cooling the Power Block, thus reducing water intake.
- 4) The facility's air quality permit requires that dust suppression activities for the material handling system be conducted. Some process water will be utilized for dust suppression at the facility's 90,000 ton coal pile, and for fogging and misting of material handling emission points, including the barge unloading area and transfer points on the conveyor belts. As stated above (Item 1), runoff from the coal pile is recycled to the gasifier slurry process. Based upon the nature of the activity, this is a small, intermittent volume. Thus, in accordance with the facility's air pollution permit, small amounts of water reuse will be conducted.
- 5) The potential to reuse process wastewater for vehicle washing and facility haul roads was evaluated. However, the CCGS air quality permit requires that the facility's haul roads be paved. Thus, watering and vehicle washing would not be a viable use of recycled waste water.

4. **Alternative process or treatment options.** Indicate what process or treatment options have been evaluated and provide the reasons they were not considered feasible.

The process treatment options that have been considered include:

- clarification and demineralization for inlet water to reduce water consumption,
- use of a ZLD to maximize water reuse and minimize discharge of pollutants,
- use of cooling tower recycle to minimize water consumption and wastewater discharge while reducing particulate emissions in the cooling tower drift,
- recirculation of coal pile run-off into the gasification process, and
- installation of a wastewater treatment plant to address sanitary waste.

Each of these process treatment options have been accepted as feasible, by CCG, and form the basis for CCG's KPDES application.

Although there is not a direct process comparison of CCGS's operation to a traditional pulverized coal (PC) plant, the water intake for a traditional PC plant is generally between 12-14 gpm/MW and a coal gasifying operation water intake is typically in the range of 13.5 gpm/MW. However, unlike a PC plant, an operation like CCGS produces both electricity (gpm/MW) and approximately 4,200 MCF of gas; thus, making the process more efficient, by producing two products at roughly the same intake volume.

## II. Alternatives Analysis - continued

5. **On-site or subsurface disposal options.** Discuss the potential for on-site or subsurface disposal. If these options are not feasible, then please indicate the reasons why.

The volume of the Applicant's wastewater discharge (1.38 MGD) renders on-site disposal in a septic system or leach bed impractical due to space constraints on Applicant's 2,050 acre site. In addition, on-site disposal would necessitate piping systems that would necessarily impact wetlands and various intermittent/ephemeral streams on the CCGS site.

Subsurface disposal is also not an option because the CCGS is sited on reclaimed surface mined land. Therefore, the subsurface character of the land is comprised of mine spoil (approaching eighty (80) feet in depth in some areas). This layer of mine spoil renders use of a septic system or leach bed technically improbable due to the presence of boulders and other soil anomalies.

Finally, the use of an on-site spray field application was evaluated; however, minimal to no space associated with the applicant's 2,050 acres is available for use as a spray field. Current planned use of the 2,050 acres includes:

- The plant footprint (i.e., material handling and storage, equipment, paved surfaces, etc.);
- Operating oil wells in the southwest corner of the site;
- Proposed slag disposal area (pending permitting approval) – all three of the uses mentioned above comprise roughly half of the site); and
- Portions (i.e., roughly half of the site - located east of the plant footprint - see map in KPDES application), if not utilized for slag disposal, will continue to be leased to private owners for use as farmland. Taking this potentially unused land off the market for use as a spray field could negatively impact both economic and agricultural growth the local area.

6. **Evaluation of any other alternatives to lowering water quality.** Describe any other alternatives that were evaluated and provide the reasons why these alternatives were not feasible.

Evaluations of alternatives to the planned wastewater discharge in CCG's KPDES application are described in Sections II-1 through II-5 above. All are either being implemented (on-site treatment and water reuse/recycle) or have been determined to be infeasible (third-party treatment works, discharge to alternative streams, and on-site subsurface disposal).

Abandonment of the project would avoid impacts to water quality from planned Project activities. However, abandonment would result in the loss of more than \$100 million dollars of annual economic activity and benefits to the community and region.

### III. Socioeconomic Demonstration

1. State the positive and beneficial effects of this facility on the existing environment or a public health problem.

The conversion of coal to natural gas and electricity dramatically reduces emissions of air pollutants as compared to traditional pulverized coal electric generation technologies. It also provides for conversion of coal to a scarce clean-burning fuel (natural gas) for home heating and automobile fuel (compressed natural gas) applications. The CCGS is also capturing CO<sub>2</sub> produced in the gasification process and has executed a contract to sell all CO<sub>2</sub> produced for Enhanced Oil Recovery ("EOR"). EOR reduces our nation's dependence on foreign oil supplies and diminishes energy price volatility in the United States. Lastly, sulfur captured in the gasification and sulfur recovery processes provides a valuable feedstock to domestic fertilizer producers.

Simply stated, this facility will: provide high quality and substantial employment to the area; increase the supply of natural gas to meet our energy needs; generate significant amounts of electricity; improve the supply of fertilizer to the agricultural community; increase the production of oil from existing wells and accomplish all of this while emitting less air pollution than any other coal fueled facility in the country.

2. Describe this facility's effect on the employment of the area

See response to III-3 below. The 2,200 additional employment opportunities (construction and full-time) will decrease Henderson County's current unemployment rate, which was 5.8% at the end of August, 2008.

3. Describe how this facility will increase or avoid the decrease of area employment.

Construction of the CCGS will generate up to 1,500 construction jobs over a 48 month period. Thereafter, the CCGS will create approximately 250 full-time operations and maintenance jobs. The Project's coal usage (2.8 million tons annually) is expected to create approximately 150 additional mining jobs. A study of a similar gasification facility by Northern Illinois University estimated that increased regional economic activity could create an additional 300 jobs.

Therefore, the CCGS is expected to create 1,500 construction and 700 new full-time employment opportunities.

4. Describe the industrial or commercial benefits to the community, including the creation of jobs, the raising of additional revenues, the creation of new or additional tax bases.

The combined economic effect of increased employment (payroll), property taxes, coal consumption (including severance tax), and indirect economic benefits (based on standard economic development multipliers) resulting from the construction and operation of the \$2.0 billion CCGS is expected to exceed \$100 million annually. Although the specific amount and allocation of the facility's annual property taxes are unknown, the facility's contribution to the local tax base is expected to benefit Henderson County schools and support maintenance and improvement activities to County facilities that will facilitate additional economic development projects.

5. Describe any other economic or social benefits to the community.

See Attachment III-5.

**III. Socioeconomic Demonstration - continued**

Yes      No

6. Will this project be likely to change median household income in the county?

See response to III-5.

7. Will this project likely change the market value of taxable property in the county?

The economic growth described in Sections III-2 through III-5 is expected to significantly increase the market value of taxable property in Henderson County.

8. Will this project increase or decrease revenues in the county?

The CCGS is expected to significantly increase property tax and coal severance tax revenues in Henderson County.

9. Will any public buildings be affected by this system?

10. How many households will be *economically* or *socially* impacted by this project?      **Direct employment opportunities could impact as many as 1,900 households in Henderson and surrounding counties. Assuming a conservative economic impact multiplier of 5X employment, 9,500 households would be positively impacted by the CCGS.**

11. How will those households be *economically* or *socially* impacted? (For example, through creation of jobs, educational opportunities, or other social or economic benefits.)

**These households will be positively impacted economically through:**

- creation of jobs (as set forth above),
- increased economic activity in the community based on the infusion of direct payroll dollars and the sale of goods and services to both the CCGS and its employees, and
- improved infrastructure premised on increased local government tax revenue.

**The CCGS will also provide increased social and educational opportunities that will be supported by both increased local and state tax bases.**

Yes      No

12. Does this project replace any other methods of sewage treatment to existing facilities? (If so describe how)

**The CCGS will not replace any methods of sewage treatment at existing facilities. However, by installing an on-site facility to treat sanitary waste produced at the site, the CCGS will not consume available treatment capacity at existing treatment facilities, thus, preserving existing capacity for future economic growth in the community.**

Yes      No

13. Does this project treat any existing sources of pollution more effectively? (If so describe how.)

**The location of the proposed CCGS is a former mine site. No existing sources (i.e., old mining equipment, fuel tanks, etc.) of pollution currently exist on site. In order for the property to be bond released per mining regulations, the site had to be reclaimed and sources of existing pollution removed.**

**III. Socioeconomic Demonstration - continued**

Yes      No

14. Does this project eliminate any other sources of discharge or pollutants?  
(If so describe how.)

The location of the proposed CCGS is a former mine site. No existing sources (i.e., old mining equipment, fuel tanks, etc.) of pollution currently exist on site. In order for the property to be bond released per mining regulations, the site had to be reclaimed and sources of existing pollution removed.

15. How will the increase in production levels positively affect the socioeconomic condition of the area?

As the CCGS is a new facility, all production represents an increase in production levels. The CCGS will use 2.8 million tons of coal each year to produce approximately 36 billion cubic feet of natural gas and 1.9 GWhs of electricity each year. Additionally, the facility will produce approximately 98,000 tons of sulfur per year to manufacture fertilizer and 4.3 million tons of carbon dioxide annually for EOR. The impact of this production on the socioeconomic condition of the area is delineated above in Sections III-1 through III-14.

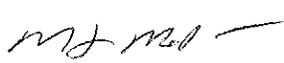
Finally, the ZLD treatment facility will treat the coal gasification wastewater in a manner that the Applicant believes to be the first application of ZLD technology to a coal gasification process. As a result of this technological advance, pollutant loading to the wastewater receiving body (the Green River) will be reduced, water withdrawal from the Green River is reduced; and a salt is produced for reuse or disposal.

16. How will the increase in operational efficiency positively affect the socioeconomic condition of the area?

Again, as the CCGS is a new facility, the operational efficiency of the plant can not be contrasted with a pre-existing efficiency. However, as is explained above, the CCGS process is extremely efficient as compared to conventional coal combustion facilities in producing natural gas and electricity while minimizing environmental impacts associated with air pollution, water pollution and solid waste production. The energy conversion efficiency of the CCGS gasification process is comparable to the most efficient existing conventional natural gas and electricity production processes.

Finally, the waste generated by the gasification process is a vitreous glass-like slag rather than the ash that is produced in coal combustion processes. This vitreous material is virtually non-leachable and does not pose a leachate risk for slag that is stored rather than being beneficially reused. This characteristic represents a significant environmental benefit in avoiding potential groundwater pollution.

**IV Certification:** I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

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Signature:		Date:	<i>3/24/09</i>

**Revised High Quality Water Alternative Analysis  
Cash Creek Generation, LLC  
Henderson County, Kentucky  
March 2009**

**Attachment II.1**

Three on-site treatment facilities were considered for the Cash Creek Generating Station ("CCGS"), specifically:

- an inlet water pretreatment facility that treats water withdrawn from the Green River to remove suspended and dissolved solids,
- a ZLD facility that treats process wastewater from the gasification process to produce a crystallized solid product that is used/disposed of off-site and treated water that is recycled to the gasification process, and
- a wastewater treatment plant to treat the sanitary wastes that are generated on site.

As part of its KPDES application, CCG has committed to install each of these on-site treatment facilities at a combined capital cost of \$83 million (excluding interest costs during construction) and an average annual energy usage of 164,000 MWhs (\$10.6 million).

In addition to on-site treatment facilities, the Applicant has considered the possibility of discharging wastewater from the CCGS to the Henderson Water Utility's ("HWU") existing treatment works. HWU operates two (2) treatment works, a 4.0 MGD facility that is located approximately 8.0 miles from the CCGS site (the South Wastewater Treatment Plant) and a 15.0 MGD facility located approximately 15.0 miles from the CCGS site (North Wastewater Treatment Plant).

As the Applicant's wastewater discharge totals 1.89 MGD, the initial review of HWU treatment facilities focused on available capacity. The South Wastewater Treatment Plant has only 1.2 MGD of capacity available (discharge constraints) and was eliminated from further consideration as being incapable of accommodating the Applicant's wastewater. The North Wastewater Treatment Plant has approximately 7.5 MGD of average available capacity and could meet the Applicant's needs. The optimum means of access to the North Wastewater Treatment Plant would require an extensive joint study with HWU. However, for purposes of this analysis, the Applicant assumed that connection cost could be minimized by interconnection at the Canoe Creek Interceptor at a distance of approximately 10.0 miles from the CCGS site.

To assess the cost of interconnecting to the Canoe Creek Interceptor, a nationally recognized architect/engineer, Burns & McDonnell, was engaged to provide a capital cost estimate. The Applicant also had discussions with the HWU to assess their estimates of interconnection cost. The capital cost consensus of Burns & McDonnell and HWU was \$1.0 million per mile for material, labor, road/railroad borings, and right-of-way. Therefore the estimated capital cost to tie to the North Wastewater Treatment Plant is \$10.0 million. Including interest during construction at a 7.0% interest rate and 18 month construction period, the cost increases to \$11,075,000.

In addition to the required capital cost, energy costs (pumping) and wastewater treatment costs were calculated based on current electricity prices and the HWU contract wastewater treatment rate currently in effect. The table below summarizes the estimated total cost of interconnecting to HWU at the Canoe Creek Interceptor.

<b>Cost Element</b>	<b>Annual Expense</b>	<b>Life-Cycle Cost (30-year)</b>
Capital Cost		\$11,075,000
Energy Cost (2 MW @ \$65/MWh)	\$1,138,800	\$34,164,000
Wastewater (\$3.11/kgals)	\$1,566,500	\$47,076,900
<b>Total Cost</b>	<b>\$2,705,300</b>	<b>\$92,315,900</b>

The on-site inlet water pretreatment facility and the ZLD facility would be required even if CCG's effluent was discharged to the HWU system. Therefore, when considering the economic feasibility of discharging to HWU, the only costs avoided by the Applicant are the capital cost associated with the wastewater treatment plant (\$700,000) and the annual energy cost (based on 0.4MWh @\$65/MWh) associated with that facility (\$6,832,800, over 30 years).

The estimated life-cycle cost of transporting the Applicant's wastewater to HWU is approximately \$92 million. The incremental cost associated with use of the HWU system is \$85.5 million (HWU cost less the cost associated with Applicant's wastewater treatment plant). Based on CCG's KPDES application, this cost represents \$20,000 to \$60,000/ton for typical wastewater pollutants (BOD5, TSS, etc) and \$100,000 to \$1,000,000/ton for metal pollutants discharged from the CCGS.

### **Attachment III.5**

Along with contributing to the Henderson County tax base, which is utilized to fund community development and schools, the employment opportunities associated with the CCGS will typically pay higher wages (ranging from \$44,000 to \$91,500) than that of the county average. This results in opportunities for personal economic growth and supports sustainable, skilled laborers and managers that will live in and support the economy of the community.

Additionally, according to the 2006 data obtained from Kentucky's Cabinet for Economic Development, the median household annual income for this area is \$29,236, which is below both the state and national averages of \$29,729 and \$36,714, respectively. Based upon 2007 data, the service industry comprises the largest percentage of jobs in Henderson County, with an average weekly wage of \$476 or an annual income of roughly \$24,750 a year. Jobs created by the CCGS will supply salaries similar to that of the manufacturing industry, with semi-skilled employees earning in excess of \$40,000 a year. The CCGS can be expected to increase the median household annual income substantially.

Furthermore, in a county where 14% of the entire population lives below the federally mandated poverty line<sup>1</sup> and nearly 20% of the children 18 years or younger are also below the poverty line, each job (direct or indirect) produced by this project is vitally important to the health and welfare of the community.

Another benefit to the community is that the production of natural gas and electricity in the CCGS results in a dramatic reduction of priority air pollutants (SO<sub>2</sub>, NO<sub>x</sub>, CO, VOC, and particulates), hazardous air pollutants (including mercury), and ozone (formed by VOC and NO<sub>x</sub>) as compared to traditional coal-fired electric generation technologies.

Finally, the CCGS will capture virtually all CO<sub>2</sub> (a greenhouse gas) generated in the gasification process. This CO<sub>2</sub> has been sold for EOR. This beneficial re-use of CO<sub>2</sub> represents only the second application of carbon capture for EOR from a coal gasification facility in North America.

**Resources Consulted**

<sup>1</sup>US Census Bureau, Small Area Income & Poverty Estimates, 2005.  
<http://www.census.gov/cgi-bin/saipe/saipe.cgi>